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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]More specifically, this invention relates to a communications system provided with the encoding method, the coding equipment, and it which carry out compression encoding of the multichannel signal about an encoding method and coding equipment.

[0002]

[Description of the Prior Art]The compression encoding system in which the multichannel reproduction which makes the start a TORUBI digital system, a MPGE-AAC method, etc. is possible is used.

[0003]Drawing 5 is a key map showing the loudspeaker arrangement of the five-channel method adopted by MPEG-ACC.

[0004]With reference to drawing 5, the multichannel audio signal corresponding to five speakers is coded in a MPEG-ACC method. Lch. (left channel) which is the conventional stereo system in a five-channel method, and Rch. (right channel) -- in addition, Add Cch. (center channel), LSch. (left surround channel), and LSch. (right surround channel), and especially by the addition of the loudspeaker of a center channel. It has the feature that the acoustic image normal position and tone quality of an important center are substantially improved by the words portion of a movie, a musical solo musical instrument, etc. It becomes possible to obtain the quality reproduced sound which was full of presence by adoption of such a multichannel method.

[0005]Drawing 6 is a key map for explaining the recording format of the sound code data according to a MPEG-ACC method.

[0006]With reference to drawing 6, the audio decoding unit of the sound code data according to a MPEG-ACC method contains header information and multichannel voice data.

Multichannel voice data contains a center channel, a left channel, a right channel, a left

surround channel, and right surround channel data. Thus, compression encoding of the multichannel signal is performed by coding and recording the audio signal corresponding to each speaker which constitutes a multichannel for every audio decoding unit. By decoding the coding data corresponding to each channel for every audio decoding unit using a decoding device, it is possible to reproduce the audio signal of a multichannel.

[0007]

[Problem(s) to be Solved by the Invention]As mentioned above, the regenerative signal corresponding to a multichannel can be acquired by receiving and decoding the sound code data according to a MPEG-AAC method.

[0008]However, in the commercial scene, the audio apparatus which has a relation of a housing situation and outputs a reproduced sound by two loudspeakers occupies the mainstream. There is also much apparatus which has provided only two output terminals from the starts, such as DVD and TV. Therefore, in order to reproduce a multichannel signal corresponding to these two-channel reproduction special-purpose-machine machines, the signal which decoded the signal of all the channels currently recorded and was acquired by decoding needed to be compounded, and the regenerative signal of two channels newly needed to be acquired.

[0009]Drawing 7 is a block diagram showing the composition of the multichannel communications system 500 of a Prior art which can respond to two-channel reproduction.

[0010]The communications system 500 is provided with the coding equipment 510 which carries out compression encoding of the multichannel signal, and the decoding device 550 which decodes the send data Yad outputted from the coding equipment 510, and outputs a two-channel regenerative signal with reference to drawing 7.

[0011]The coding equipment 510 outputs the send data Yad which has the recording format explained by drawing 5 in response to the fact that the audio signal X of each channel (C), X (L), X (R), X (SL), and X (SR). The decode processing circuit 560 which the decoding device 550 decodes this in response to the send data Yad, and outputs the audio signal of each channel, The down mix signal generating circuit 570 which outputs the two-channel regenerative signal X (Lo) and X (Ro) based on the audio signal of five channels decoded by the decode processing circuit is included.

[0012]Thus, in the decoding device 550, the audio signal of all the channels was decoded by the decode processing circuit 560, and the two-channel regenerative signal X (Lo) and X (Ro) have been obtained by carrying out the down mix of those signals further. For this reason, it was dramatically difficult for LSI for decoding used for the decoding device 550 to require high-speed mass data-processing capability, and to attain low cost-ization of a decoding device.

[0013]Made in order that this invention may solve such a problem, the purpose of this invention is to provide a communications system provided with the coding equipment and it which

perform the coding which can constitute the decoding device corresponding to a two-channel reproduction special-purpose-machine machine from low cost.

[0014]

[Means for Solving the Problem]An encoding method of claim 1 is an encoding method which codes a multichannel signal which consists of N channel signals (N:3 or more natural numbers), and carries out the down mix of the N channel signals, A step which generates a signal only for two-channel reproduction corresponding to two-channel playback apparatus, A step which codes independently a signal only for two-channel reproduction, and other channel signals, Having a step which records coded data for every decoding unit according to a predetermined format, a step to record records independently coding data corresponding to a signal only for two-channel reproduction, and other channel signals, respectively.

[0015]The encoding method according to claim 2 is the encoding method according to claim 1, and a step to record records coding data corresponding to a signal only for two-channel reproduction ahead of coding data corresponding to other channel signals.

[0016]The encoding method according to claim 3 is the encoding method according to claim 1, and N channel signals, Including other channel signals of an individual which is the target of compression encoding (N-2), and the other two channel signals, by compounding other channel signals and a signal only for two-channel reproduction, other channel signals are chosen so that the other two channel signals can be reproduced.

[0017]The coding equipment according to claim 4 is coding equipment which codes a multichannel signal which consists of N channel signals (N:3 or more natural numbers), and carries out the down mix of the N channel signals, A down mix circuit which generates a signal only for two-channel reproduction corresponding to two-channel playback apparatus, A signal only for two-channel reproduction and other channel signals are coded, and it has an encoding processing circuit which outputs a send data signal which recorded independently coding data corresponding to each of a signal only for two-channel reproduction, and other channel signals.

[0018]The coding equipment according to claim 5 is the coding equipment according to claim 4, and an encoding processing circuit, Coding data is recorded for every decoding unit according to a predetermined recording format, a send data signal is generated and coding data corresponding to a signal only for two-channel reproduction is recorded ahead of coding data corresponding to other channel signals in a recording format.

[0019]The coding equipment according to claim 6 is the coding equipment according to claim 4, and an encoding processing circuit, From inside of a multichannel signal, code and other channel signals of an individual (N-2) except two channel signals, and a signal only for two-channel reproduction other channel signals, By compounding other channel signals and a signal only for two-channel reproduction, it is chosen so that two channel signals can be

reproduced.

[0020]The communications system according to claim 7 is a communications system which transmits and receives a multichannel signal which consists of N channel signals (N:3 or more natural numbers), Have coding equipment which codes a multichannel signal and coding equipment, A down mix circuit which carries out the down mix of the N channel signals, and generates a signal only for two-channel reproduction corresponding to two-channel playback apparatus, Code a signal only for two-channel reproduction, and other channel signals, and an encoding processing circuit which outputs a send data signal which recorded independently coding data corresponding to each of a signal only for two-channel reproduction and other channel signals is included, Having further a decoding device which decodes a send data signal and outputs a reproduced sound signal, a decoding device includes the 1st decode processing circuit that decodes coding data corresponding to a signal only for two-channel reproduction.

[0021]The communications system according to claim 8 is the communications system according to claim 7, and an encoding processing circuit, Coding data is recorded for every decoding unit according to a predetermined recording format, a send data signal is generated and coding data corresponding to a signal only for two-channel reproduction is recorded ahead of coding data corresponding to other channel signals in a recording format.

[0022]The communications system according to claim 9 is the communications system according to claim 7, and an encoding processing circuit, From inside of a multichannel signal, code and other channel signals of an individual (N-2) except two channel signals, and a signal only for two-channel reproduction other channel signals, Are chosen so that two channel signals which are outside an object of coding by compounding other channel signals and a signal only for two-channel reproduction can be reproduced, and a decoding device, In response to a send data signal, a digital disposal circuit which outputs two channel signals which were outside an object of coding is further included in response to a decode output of the 2nd decoding device that decodes coding data corresponding to other channel signals, and the 1st and 2nd decoding devices.

[0023]The communications system according to claim 10 is the communications system according to claim 9, a multichannel signal is a signal according to a MPEG-AAC method, and two channel signals which are outside an object of coding are equivalent to an audio signal of a surround speaker.

[0024]

[Embodiment of the Invention]Below, an embodiment of the invention is described in detail with reference to drawings. The identical codes in a figure show a same or considerable portion.

[0025][Embodiment 1] Drawing 1 is a block diagram explaining the composition of the multichannel communications system 100 which can respond to the two-channel reproduction

according to Embodiment 1.

[0026]The communications system 100 is provided with the following with reference to drawing 1.

Coding equipment 110 which outputs send data Yadd in response to the fact that the audio signal X of a multichannel (C), X (L), X (R), X (SL), and X (SR).

The decoding device 150 which outputs the two-channel regenerative signal X (Lo) and X (Ro) in response to send data Yadd.

[0027]In Embodiment 1, the two-channel regenerative signal acquired by carrying out the down mix of the signal required for two-channel reproduction at the time of coding beforehand is coded directly.

[0028]The down mix circuit 120 where the coding equipment 110 outputs the two-channel regenerative signal X (Lo) and X (Ro) in response to the fact that the audio signal X of five channels (C), X (L), X (R), X (SL), and X (SR), The encoding processing circuit 130 which performs compression encoding in response to the fact that the audio signal X (C), X (L) and X (R), X (Lo) that is the outputs of a down mix circuit signal, and X (Ro), and outputs send data Yadd is included.

[0029]In response to the audio signal of five channels which constitutes a multichannel signal, according to a lower type (1) and (2), the down mix circuit 120 performs a down mix, and outputs the signal X only for two-channel reproduction (Lo), and X (Ro).

[0030]

$$X(Lo) = X(L) + \alpha \cdot X(C) + \beta \cdot X(SL) \quad -- (1)$$

$$X(Ro) = X(R) + \alpha \cdot X(C) + \beta \cdot X(SR) \quad -- (2)$$

$\alpha$  and  $\beta$  in (1) type and (2) types are a constant.

[0031]The encoding processing circuit 130 performs compression encoding, in response to the fact that X (C) which is a part of Mull channel signal, X (L) and X (R), the down mix signal X (Lo), and X (Ro), and it outputs the sending signal Yadd.

[0032]Drawing 2 is a key map explaining the recording format for every audio decoding unit of the sending signal Yadd which the coding equipment according to Embodiment 1 outputs.

[0033]With reference to drawing 2, the audio decoding unit of the sending signal Yadd contains header information and multichannel voice data. Multichannel voice data is provided with the following.

Corresponding-to Loch. [ which was produced by carrying out a down mix ], and Roch. voice data.

Voice data corresponding to Cch., Lch., and Rch. which are a part of multichannel signals.

Such voice data is recorded independently.

[0034]In the form where the data of SLch. corresponding to a surround channel and SRch.

stored by the Prior art in send data is replaced. Since the voice data corresponding to Loch. produced by carrying out a down mix and Roch. is contained, the storage capacity for every audio decoding unit has the feature that it is not different from the conventional thing at all. The recording format of a multichannel voice data portion, Since it is the composition which records previously a down mix signal required for only for two-channel reproduction, and records the signal of a multichannel continuously, the decoding capability of a decoding device can be utilized efficiently to decode only a down mix signal.

[0035]The decoding device 150 performs decoding in response to the sending signal Yadd. Since the signal by which the down mix was carried out is directly recorded by the sending signal Yadd only on two-channel reproduction, the decode processing circuit 160 included in the decoding device 150, It is only decoding the signal for two channels, and it is possible to acquire a down mix signal required for two-channel reproduction. When aiming only at two-channel reproduction, the information on the remaining channels can acquire an audio signal required for two-channel reproduction by flying without processing by decoding even the signal of header information, Loch., and Roch. In this case, about 2/5 of the capability to decode conventional all of five channels may be sufficient as signal-processing capability required for a decode processing circuit, and it becomes possible to use cheap LSI and it becomes possible to low-cost-ize the decoding device only for two-channel reproduction. Since it does not decode about the signal of an unnecessary channel, reduction of the power consumption of the decoding device only for two-channel reproduction can also be aimed at.

[0036]Since the storage capacity for every audio decoding unit is not different from the conventional thing at all as drawing 2 explained, it is not necessary to raise the capability of a decode processing circuit corresponding to change of a recording format.

[0037][Modification of Embodiment 1] In the modification of Embodiment 1, the composition of the decoding device which can decode all the channel signals of the original multichannel is provided corresponding to the recording format of the send data which can respond to the two-channel reproduction explained by drawing 2 easily.

[0038]Drawing 3 is a block diagram explaining the composition of the communications system 200 according to the modification of the embodiment of the invention 1.

[0039]With reference to drawing 3, the communications systems 200 differ in that replace with the decoding device 150 and it has the decoding device 250 as compared with the communications system 100 explained by drawing 1. The decoding device 250 is provided with the following.

Decode processing circuit 260.

Surrounding-signals generation circuit 280.

[0040]The decode processing circuit 260 is added to the decode processing circuit 160

explained by Embodiment 1, and includes further the decode processing circuit 165 for decoding also about the signal X of channels other than the down mix signal included in a sending signal (C), X (L), and X (R). Therefore, the decode processing circuit 260 outputs the signal of each channel of X (C), X (L), X (R), X (Lo), and X (Ro) transmitted by the sending signal.

[0041]The surrounding-signals generation circuit 280 outputs the surrounding signals X (SL) and X (SR) in response to the signal of each channel which the decode processing circuit 260 outputs. The surrounding-signals generation circuit 280 outputs the signal of a surround channel based on a lower type (3) and (4) using the constant alpha used in the down mix circuit 120 in coding equipment.

[0042]

$$X(SL) = X(Lo) - \alpha \cdot X(C) - X(L) \quad \text{-- (3)}$$

$$X(SR) = X(Ro) - \alpha \cdot X(C) - X(R) \quad \text{-- (4)}$$

Even if it uses the send data which has a recording format which can decode efficiently a signal required for two-channel reproduction which was explained by drawing 2 by having such composition, the signal about all the channels of the original multichannel can be decoded.

[0043]Since the composition of the coding equipment 110 in drawing 3 is the same as drawing 1 explained, explanation is not repeated.

[0044]As mentioned above, while making possible low-cost-izing and low power consumption of the decoding device only for two-channel reproduction by communicating a multichannel signal by the recording format which codes directly the signal which carried out the down mix beforehand, The compatibility to the audio apparatus in which multichannel reproduction is possible is also maintainable. Therefore, while being able to manufacture the cheap popular edition only for two-channel reproduction, the correspondence to the higher rank model which met the various consumer needs is also attained.

[0045]Next, the procedure of the coding in the coding equipment explained by this invention is explained using a flow chart.

[0046]Drawing 4 is a flowchart in which the encoding method 300 of the multichannel signal according to this invention is shown. The encoding method 300 shows the encoding method in every decoding unit.

[0047]With reference to drawing 4, the encoding method 300 according to this invention is provided with the following.

Step S10 which starts coding processing of one decoding unit.

Step S20 which carries out the down mix of the multichannel signal.

Step S30 which codes the signal acquired by carrying out a down mix, and the signal of a part of multichannel signal.

Step S40 which records the coded data for every decoding unit according to a predetermined

format, and Step S50 which ends coding processing of one decoding unit.

[0048]Processing of Step S20 is for being equivalent to operation of the down mix circuit 120 explained by drawing 1, performing a down mix based on (1) and (2) types, and acquiring the signal only for two-channel reproduction.

[0049]Processing of Steps S30 and S40 is equivalent to operation of the encoding processing circuit 130 explained by drawing 1. Step S30 codes independently the signal signal only for two-channel reproduction acquired by carrying out a down mix, and the signal of a part of multichannel signal. The remaining signals of the multichannel signal carried out the outside of the object of coding at Step S30 can be compounded based on (3) and (4) types which were already explained at the time of decoding. In other words, in a relation with the computing equation ((1), (2) types) of a down mix, the channel signal which becomes the outside of the object/object of coding is chosen, respectively so that all the original channel signal can be compounded at the time of decoding at the time of decoding.

[0050]Since the recording format in Step S40 is as drawing 2 having explained, explanation is not repeated.

[0051]By performing the encoding method by such a procedure, the signal only for two-channel reproduction can be decoded efficiently, and it becomes possible from a multichannel signal to constitute the decoding device corresponding to a two-channel reproduction special-purpose-machine machine from low cost.

[0052]Although the MPEG-ACC method was illustrated and the art for acquiring the signal only for two-channel reproduction efficiently based on the multi-channel signal of five channels was explained in the embodiment of the invention, In such a case, application of this invention is not limited, and by the same procedure or composition. Applying widely is possible when acquiring efficiently the signal only for N channel reproduction (natural number of  $N:N < M$ ) based on the multi-channel signal of M channel (M: natural number) to the origin of other coding modes.

[0053]With all the points, the embodiment indicated this time is illustration and should be considered not to be restrictive. The range of this invention is shown by the above-mentioned not explanation but claim, and it is meant that a claim, an equivalent meaning, and all the change in within the limits are included.

[0054]

[Effect of the Invention]Since the encoding method according to claim 1 codes the signal only for two-channel reproduction which carried out the down mix beforehand, and other channel signals and records them independently, Decoding capability required in order to acquire the signal only for two-channel reproduction can be stopped, and the decoding device which executes decoding corresponding to 2 chain flannel reproduction special-purpose-machine



machine from the data coded by the encoding method concerned can consist of low cost.

[0055]Since the format which records the data corresponding to the signal only for two-channel reproduction ahead of the data of other channel signals is used for the encoding method according to claim 2, Decoding for acquiring the signal only for two-channel reproduction from the data coded by the encoding method concerned in addition to the effect that the encoding method according to claim 1 does so can be performed more efficiently.

[0056]Since the encoding method according to claim 3 can compound the two remaining channel signals that were not coded with the signal only for two-channel reproduction, and other channel signaling of an individual (N-2), In addition to the effect that the encoding method according to claim 1 does so, the signal of all the channels of the original multichannel signal can be decoded, without causing the increase in storage capacity.

[0057]Since the coding equipment according to claim 4 codes the signal only for two-channel reproduction which carried out the down mix beforehand, and other channel signals and records them independently, Decoding capability required in order to acquire the signal only for two-channel reproduction can be stopped, and the decoding device which executes decoding corresponding to 2 channel flannel reproduction special-purpose-machine machine from the data coded by the coding equipment concerned can consist of low cost.

[0058]Since the format which records the data corresponding to the signal only for two-channel reproduction ahead of the data of other channel signals is used for the coding equipment according to claim 5, Decoding for acquiring the signal only for two-channel reproduction from the data coded by the coding equipment concerned in addition to the effect that the coding equipment according to claim 4 does so can be performed more efficiently.

[0059]Since the coding equipment according to claim 6 can compound the two remaining channel signals that were not coded with the signal only for two-channel reproduction, and other channel signaling of an individual (N-2), In addition to the effect that the coding equipment according to claim 4 does so, the signal of all the channels of the original multichannel signal can be decoded, without causing the increase in storage capacity.

[0060]Coding equipment which the communications system according to claim 7 codes the signal only for two-channel reproduction which carried out the down mix beforehand, and other channel signals, and is recorded independently, Since it has the decoding device which specialized the signal only for two-channel reproduction in decoding, the decoding device corresponding to 2 channel flannel reproduction special-purpose-machine machine can consist of low cost.

[0061]Since the communications system according to claim 8 is provided with the coding equipment which adopts the format which records the data corresponding to the signal only for two-channel reproduction ahead of the data of other channel signals, In addition to the effect that the communications system according to claim 7 does so, decoding for acquiring the

signal only for two-channel reproduction can be performed more efficiently.

[0062] Since the communications system according to claim 9 establishes the digital disposal circuit which can compound the two remaining channel signals that were not coded with the signal only for two-channel reproduction, and other channel signaling of an individual (N-2) in a decoding device, In addition to the effect that the communications system according to claim 7 does so, the signal of all the channels of the original multichannel signal can be decoded, without causing the increase in storage capacity.

[0063] In transmission and reception of the multichannel according to a MPED-ACC method, the communications system according to claim 10 can \*\* enjoying the effect that the communications system according to claim 9 does so.

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[Translation done.]